

9.5 APPROVALS

Refer to [Section 9.7](#) Division Procedures for approval processes.

9.6 STANDARD FORMAT

9.6.1 Plans

Project plans as described under [Section 9.4.9](#) should be prepared using the guidance provided in this section. Following these guides will produce plan sheets that are accurate, neat, presentable and that will reproduce legibly.

The following sections detail the format, drafting standards and organization of the plan sheets into a PS&E assembly.

9.6.1.1 Format

All plan sheets should be prepared using a CADD system. There may be some exceptions (e.g., conceptual drawing, architectural renditions, emergency projects) to accommodate special needs of internal sections or cooperating agencies, but these should be few in number. When manual drafting becomes necessary, it should be accomplished in a manner that duplicates the appearance of CADD drafting to the extent possible. Refer to Division Procedures for CADD plan sheets format.

9.6.1.2 Drafting Standards

The use of drafting standards establishes uniformity and quality in the drafting of contract plans. Refer to Division Procedures for drafting standards.

When a CADD system is used to develop plans, the dexterity of a manual drafter is no longer critical; letter spacing is correct and lines are uniform throughout their lengths. However, a CADD system operator must have the same knowledge of drawing layout and detailing as a manual drafter to produce a good drawing. The CADD operator must use care in laying out details when placing text on a plan sheet. The relationship between the text and what it applies to must be clear.

Notes on plan drawings should clarify the drawing and provide necessary information for a complete understanding of the work. Notes shall be clear, concise, descriptive and as brief as possible to convey the message. Plan drawings must not include instructions covered in the *Specifications*.

CADD text shall be in the correct style and at the size specified. Proper spacing between figures, symbols and words will assure clarity, improve neatness and increase accuracy.

In line work, the operator must select the correct level, line style and weight and use them in the correct relationship to other lines on the plans. The system reacts to instructions. The operator must know what is needed and how to direct the CADD system.

Drafting details that enhance the uniformity and consistency of plan preparation include the following:

- Do not go overboard on line weights. Make a good, clear delineation of all lines so the proposed work will stand out in contrast to existing features. Do not make line weights so bold that they resemble a border line.
- Do not use “station” as a prefix to station numbers. Any numbering including a plus sign (for example 2+959) is understood to be a station number.
- When placing text on plan sheets, do not crowd other information. Carefully choose a place for the notes that is as close as possible to the point of application.
- Do not use broad triangles instead of arrowheads for cross-section indicators. Place the section letters at the end of the arrows, not on one side.
- Do not use the letters “I,” “O,” “N” or “Z” as cross-section indicators. “I” and “O” resemble symbols shown on drawings and “N” and “Z” are the same shape, but oriented 90 degrees. When you reach the end of the alphabet, use AA, BB, etc.
- Do not draw hidden contours under a structure with long dashes. Make dashes 3 mm (0.12 in) long with 1.5 mm (0.06 in) spaces between. Show hidden lines of structures with the same symbol.
- Avoid running hatching, lines or patterning through words or figures. Do not use the border lines of the sheets as a basis for establishing angle of parallel hatching lines. Gradually change the direction of hatching at angle points in the section to maintain a 45-degree angle with the neat line of the structure.
- Use abbreviations on plan and profile sheets only where there is not enough space to spell out the word. In instances where the meaning of abbreviation appears doubtful, the word should be spelled out.
- Do not capitalize abbreviations unless the word or words represented are ordinarily capitalized, or unless the abbreviation itself has become established as a capital letter, such as N for north.
- A period usually follows each part of an abbreviation that represents a single word. This aids in quick interpretation of an abbreviation (e.g., “a.m.”, not “am”). The exception to a period following an abbreviation is with units of measure where periods are not used.

Deviations are acceptable provided basic drafting practices are followed and the deviation will improve the drawings. There are situations where the size and weights need to be adjusted to emphasize or clarify specific information on a plan sheet. For example, centerline stationing along the plan alignment may require a heavier weight for clarity where culture or other background data tends to clutter up a drawing.

9.6.1.3 Organization of Plans

The [FAPG, Subchapter G, Part 630, Subpart B](#) provides guidelines in the preparation of plans, specifications and estimates. The guidelines are presented in a non-regulatory supplement attachment to Part B.

The guidelines in the *FAPG* list the following 12 subject areas for the arrangement of plan sheets in the preparation of a set of contract plans.

1. Title Sheet,
2. Typical Section,
3. Summary of Quantities,
4. Tabulation of Quantities,
5. Plan and Profile,
6. bridges,
7. drainage facilities,
8. Traffic Control Plan,
9. *Standard Plans* and Special Details,
10. environmental mitigation,
11. Cross Sections, and
12. contiguous projects.

The *Guidelines* permit some latitude in the arrangement of plan sheets provided the intent of the plans is clear and meet the criteria of [Section 9.4.9](#). Designers should decide on an arrangement that best fits their needs within the *Guidelines*. Refer to the Division procedures for arrangement and organization of plan sheets and for examples of sample plan sheets.

The discussion that follows addresses some of the details needed to complete each of the 12 subject areas listed for the arrangement of the plans. For convenience, the discussion will follow the order as listed above.

9.6.1.3.1 Title Sheet

The Title Sheet serves to identify the location and limits of the project so bidders can find it in the field. Descriptive terms appearing on the Title Sheet should be readily identifiable by the topography or culture or by use of State highway maps.

Details that help to clarify the limits of the work or provide data needed to conveniently bid the work are encouraged. Additional details that may help the bidders include: locations of material sources described in Section 105, locations of disposal areas, staging areas, stockpile sites and off-project mitigation work.

The [FAPG](#) recommends that the scales used on the plans show on the Title Sheet. Considering the number of scale variations found in a typical project, a scale legend could be confusing and difficult to cross-check. Therefore, the Title Sheet exhibits show only a bar scale for the map appearing on that sheet.

A completed Title Sheet contains the following data:

- Proper title and project designation.
- Statement of the project length.
- The State, county, city or town (and, where applicable, the National Forest, National Park, etc.).
- Key map of the State with designator showing project location.
- The location or route map showing project location with beginning and ending stations or termini.
- Index of sheets comprising the plans.
- Design classifications (e.g., the current average daily traffic (ADT), design year ADT, design hourly volume (DHV), directional distribution (D), percent of trucks (T), design speed (V) and maximum superelevation rate (e)).
- Distance from the project to nearest city, town, etc.
- Provisions for dates and signatures of the approving officials.
- *Standard Specifications* applicable to the project.

The location or route map should be prepared using a scale ratio of 1:100 000 or larger and show the project area, the nearest towns appearing on a State highway map, other roads, railroads, major streams, etc. In instances where sufficient information cannot be placed on the route map to adequately identify the project work, additional vicinity maps should be prepared on separate sheets and placed following the Title Sheet.

The large number of symbols and abbreviations used within FLH precludes placing the information on the Title Sheet. Therefore, a separate Plan Symbols and Abbreviations Sheet should be used and generally follows the Title Sheet in a set of plans.

When a special symbol is required that is not included, show it in a legend on either the first plan sheet where the symbol appears or on the left side of the first Plan and Profile Sheet. Abbreviations not shown may be placed on the plans similar to the way symbols are placed, or may be added to the contract as a Special Contract Requirement under Subsection 101.03 of the *Specifications*.

The symbols and abbreviations should not be changed on a project-to-project basis. When a change is required to satisfy a Division's needs, change the master file so all future projects will have the same symbols and abbreviations. This prevents the need to check all the data on the sheet for every project.

9.6.1.3.2 Typical Sections

The Typical Section Sheet shows the shape of the finished surface and shoulders, and represents the appearance of the completed project. It must be specific enough to describe the proposed work, its location and the material needed.

For combined roadway and bridge projects, the typical section for the bridge may be shown with other bridge design information. All plans should show typical sections for the project including those for bridges only and those where abbreviated plans are used. On projects requiring more than one Typical Section, the limiting stations for each section should show. This may require additional plan sheets for clarification of the work.

Identify all functional elements of the typical section to a relative scale. Show widths in meters (feet) and show thickness or depth in millimeters (inches). Show the thickness of each element in the pavement structure in millimeters (inches).

Where different pavement structure thicknesses are necessary because of differing soil conditions, use notes or tables on the Typical Section Sheet to cover such variations.

For stage construction projects, identify the ultimate typical section. Clearly distinguish the work to be performed under the contract and the future stage construction work.

Include tables or notes to illustrate curve widening, relationship of slope ratios to cut and fill heights, slope rounding and other special treatments.

Identify the profile grade on the Typical Section Sheet at the point where it is carried relative to superelevation.

Use supplemental typical sections to show variations in special ditches, clearing widths, rock cuts, etc. Also use supplemental typical sections to detail curbs, median treatments, slope protection, channel changes, etc. Place these supplemental typical sections on the Typical Section Sheet or on a following sheet. List the stations where the typical sections apply. Place a note on the Plan and Profile Sheet describing the site-specific work and referencing the appropriate typical section. On abbreviated plans, supplemental typical sections may be placed on the plan sheet at the locations where the work is proposed.

9.6.1.3.3 Summary of Quantities

The summary of quantities tabulates, combines and summarizes quantities of the various construction items. This summary informs prospective bidders of where to locate work within the plan sheets, the difference between plan quantities and bid schedule quantities, if any, and expands on contract bid schedule information. It also serves as a helpful checklist to the designer to ensure that all elements of the design receive consideration.

This is generally one of the last plan sheets prepared in final form. All the pay items are listed in numerical order and identified by appropriate descriptions using the engineer's estimate

program. The bid schedule quantities duplicate those in the contract. Show any pertinent information by the use of remarks or footnotes at the bottom of the Summary Plan Sheet. Items of work paid for under the contract quantity provision of Section 109 should be identified when preparing the engineer's estimate.

In the preparation of the Summary of Quantities Sheet or the Tabulation of Quantities Sheets, always spell out the pay unit the way it is shown in the FLH master pay item list. Symbols for pay units are expressed without periods (e.g., m (ft), m² (ft²), kg (lb), etc). Conformity with the information shown on the Plan Symbols and Abbreviations Sheet will improve the consistency of a set of plans.

9.6.1.3.4 Tabulation of Quantities

A Tabulation of Quantities Sheet consists of a detailed summary of an item of work or several items of work usually presented in a tabular or table format. It provides bidders with more detailed information on the location and extent of the work required than can be shown on the Summary of Quantities Sheet. The following provides a description of typical Tabulation of Quantities Sheets:

1. **Drainage Tabulation.** The Tabulation of Drainage Quantities Sheet lists all culvert and related drainage data. Show the location of the drainage installation under the station heading. Show related data in the row across the sheet under an appropriate column heading. Total the figures in the various columns to obtain the quantities shown on the Summary of Quantities Sheet for the appropriate culvert item.

The Tabulation of Drainage Quantities Sheet may be developed using a spreadsheet format. The designer may modify the sheet layout to address specific project requirements.

Where maximum cover is the controlling factor in acceptable culvert pipe selection, the format shown on the exhibit works well. Where environmental factors control acceptable culvert pipe selection, it may be necessary to modify the spreadsheet layout considerably. For instance, a large portion of the Sheet may be required to detail the various coating options or thickness options acceptable for a certain pipe installation. A designer may reserve the right hand portion of the sheet for remarks and list acceptable culvert pipe along the bottom of the sheet. The primary purpose of the Summary of Drainage Quantities Sheet is to present all available options for potential bidders to evaluate in preparing their estimate for the project.

Where maximum cover is the controlling factor on acceptable culvert pipe, the designer has the option of specifying the thickness, class or type of culvert on the summary or simply checking off the acceptable column spaces and having the contractor or supplier determine the thickness, class or type.

2. **Other Tabulations.** A Tabulation of Quantities Sheet should be placed as close to the location or description of the work as possible. Use a separate plan sheet for the tables

or place the tables on the same sheet as the details for the work. Separate sheets are required when the tabulation is supported by work detailed on FLH standards or Division standard details.

Placing a tabulation of pavement structure quantities table immediately before or on the Typical Section Sheet in groups where the required work is in one location and is easy to comprehend and check. Placing a tabulation of guardrail locations immediately before the standards used for guardrail installation connects the work and location very nicely.

Tabulation of quantity tables placed immediately before the Plan and Profile Sheets for items of work (e.g., removal of individual trees, roadway obliteration, roadway excavation, turf establishment) aids the bidders in precisely locating the work areas and determining the effort required to perform the work. Tabulations for items of work (e.g., guardrail, fences) may be placed before the Plan and Profile Sheets or before the Special and *Standard Drawings* detailing the installation of those work items.

A sheet tabulating all the items required and placed immediately before the detail sheets for a major parking area, a roadside development area, a scenic overlook or other special work assists bidders as well as internal checking. This also applies to traffic control plans, signing plans, landscaping plans and other work.

The items and quantities shown on the exhibits are for example purposes only and do not reflect the work shown on the plans. They are intended to show one of several acceptable methods of tabulating the work. The designer may use any format that presents the work items in a clear and concise manner that can be easily checked and verified. The exhibits are grouped in one location instead of being spread through the remaining exhibits for convenience only.

9.6.1.3.5 Plan and Profile

Under this subject area, the designer may incorporate either contract Plan and Profile Sheets or abbreviated plan sheets.

Plan and Profile Sheets should be prepared at a scale that is adequate to show the necessary details as governed by the topography and the complexity of the work.

Plans usually have a horizontal scale of 1:1000 or 1:2000 (1:1200 or 1:2400) when prepared on the 279-mm by 432-mm (11-in by 17-in) sheet size. Larger or smaller scales can be used depending on the amount of detail to be shown.

Profiles usually have the same horizontal scale as the plan, but the vertical scale should be five or ten times that of the horizontal scale.

When laying out Plan and Profile Sheets, avoid dividing major structures, highway intersections, interchanges or grade separations between sheets. Use supplemental sheets as necessary to make these drawings as clear as possible.

Leave about 250 mm (10 in) of blank space before the beginning of the project on the first Plan and Profile Sheet and a similar blank space after the end of project on the final Plan and Profile Sheet. Use the blank space on the first Plan and Profile Sheet for project specific legends, utility information and other miscellaneous information beneficial to the contractor. Except for the first and last sheet, attempt to place 350 or 700 m (1500 or 3000 ft) on a sheet and always break sheets at even 50 or 100 m (100 ft) station numbers. Increasing stationing should run from left to right.

Show a prominent North arrow for orientation on each sheet.

Show all boundary lines, State, county, city, township and section lines. Where ties are shown to section corners that fall off the sheet, break the line and show the corner with tie distance. Describe found corners and show their coordinates. At the bottom of the plan portion of the sheet, show township, range and meridian. Streams, lakes, swamps, estuaries, etc., must also be shown.

Show the station coordinates of the beginning of the project and the end of the project on the first and final Plan and Profile Sheets, as appropriate. Identify them as State grid or assumed.

On the first sheet, show the elevation datum (e.g., USC&GS, USGS, assumed) used for the project.

Show the designed centerline prominently and comply with the following:

- If the designed line (L line) is not staked, show the preliminary control line (P line), if staked, as a light line. Label the P line as “Line as staked” and the L line as “Line to be constructed.” Where the preliminary control line consists of a series of survey control points to be used by the contractor during the construction staking operation, label the control points by number and show the coordinates and elevation on a separate tabulation sheet.
- If the L line is staked, do not show the P line on the Plan and Profile Sheets. Label the L line as “Line as staked and to be constructed.” Where control points are provided for the contractor’s staking operation, label the points by number and show coordinates and elevations. The exhibits cover this condition.
- If an L line is staked but later another line is selected for construction, make the staked line dashed and label it as “Line as staked” and make the other line solid and label it as “Line to be constructed.”

On all sheets, show the cut and fill slope limits, access control lines, easements and right-of-way lines. Within the right-of-way, show all cultural features requiring relocation (e.g., utilities, fences). Identify all ownerships for right-of-way purposes. Show all drainage structures. Show any cultural features adjacent to the right-of-way that may be affected by the project.

Curve data consisting of delta angle, radius of curve, tangent length, length of curve and superelevation should be shown. Curve widening may also be shown at this location. For spiral

transitions, the spiral angle and length of spiral should be shown. Identify every 100-m (100-ft) station along the centerline. Bearings or azimuths of all tangents should be shown.

Show the location of borings, test pits or other sites where subsurface investigations have been made on the plan portion of the Plan and Profile Sheet. Do not show actual log or test results on the plan-profile. Use separate plan sheets for this data.

On the profile portion of the Plan and Profile Sheets show the profile grade and existing ground lines. Show gradients on the profile to four decimal places, grade elevations to three decimal places and natural ground points to two decimal places.

Show vertical and horizontal clearances for railroads, highways and streambeds under proposed and existing structures.

Identify and show type and clearance under and over utility lines within the right-of-way.

In addition to profile data, the quantity and limits of the following items may be shown by arrow diagram at the bottom of the Plan and Profile Sheet.

- turf establishment;
- clearing and grubbing;
- embankment, where it occurs;
- roadway excavation where it occurs; and
- balance points if desired.

At the top of the profile portion of the sheet, the designer may show information (e.g., curbs, fences, guardrail) at the proper stations and identify them appropriately. These items may show instead on separate sheets using tables, tabulations or other appropriate formats.

Show profiles of connecting roads, waterlines, road approaches, etc., on the Plan and Profile Sheet. Offset their location on the plan if they obscure the main profile or show them on a separate plane sheet.

Show bridges and major structures to be constructed on the Plan and Profile Sheet in outline only, with a note to see the appropriate drawings.

Show irrigation facilities requiring minimum service interruptions during construction of the project.

Show all culverts on the Plan and Profile Sheets.

Abbreviated plans are acceptable on rehabilitation type work, emergency relief work or other types of work where Plan and Profile Sheets would not clarify the required construction.

The work areas can be identified along the route by stations, km (mile) posts, and etc., with a written description of the work to be performed at each site.

The description is used to identify work details, specify quantities, and reference Special Details or *Standard Plans or Details* elsewhere in the plans. The information may be placed in a tabular format or may be included as descriptive text at the specific work locations as shown on a straight-line diagram or graph. Any plan format that is clear, concise and adequately details the work is generally acceptable.

9.6.1.3.6 Bridges

Most bridges and other large structures are designed by the bridge design units. Number the drawings properly for insertion in the final package. Structure sheets may be inserted into the plan package following the Plan and Profile Sheets (refer to Division Procedures).

9.6.1.3.7 Drainage Facilities

Plan sheets under this subject area would include details of large culvert installations conforming to the requirements listed in [Chapter 7](#). Headwalls, inlet and outlet treatments, fish passage requirements, energy dissipators, catch basins, manholes and other drainage installation can also be detailed under this subject area. The drainage plan sheets should be numbered and placed in the plans in logical order as determined by the designer. The plan sheets may be combined with the Drainage Summary Sheet to keep all similar work in one location in the plans.

9.6.1.3.8 Temporary Traffic Control Plan (TTCP)

The plan sheets for the Temporary Traffic Control Plan are Special Drawings that graphically portray all temporary traffic controls required to assure safe passage of traffic through a specific project construction zone. All pay items related to temporary traffic control may be tabulated on this Sheet or have a separate tabulation sheet.

Temporary Traffic Control Plans may range from simple line diagrams for low-volume rural roads to complex plan sheets detailing every stage of the project work on high-volume urban highways. Guidance on Temporary Traffic Control Plans is provided in the [MUTCD](#).

9.6.1.3.9 Standard Drawings, Standard Details and Special Details

FLH *Standard Drawings* are usually incorporated into the contract plan assembly and not issued as a separate booklet. Special Detail Sheets, including Division *Standard Details* and project specific details, necessary to properly describe the work, may be placed under this subject area. Arrange the *Standard Drawings*, *Standard Details* and project specific Special Details in an order that best clarifies the work to be accomplished.

1. **FLH Standard Drawings.** FLH *Standard Drawings* cover various design elements that have been approved by FLHO for use on a nationwide basis. FLH *Standard Drawings*

have a fixed format and each drawing has its own unique identification number. They cannot be changed by a Division Office and used as a *Standard Drawing*. If changes are made, they become Special Details. See [Section 9.4.9](#).

2. **Division *Standard Details*.** These drawings are used on a continuing basis within each Division. They should be placed in the plans to clarify the work required.

Standard Plans prepared by State DOT's or other outside agencies that are incorporated into the contract should be treated as Division *Standard Details* for insertion into the plans package.

3. **Special Details.** Special Details are plan sheets detailing grade crossings, turnouts, retaining walls, dikes and ponds, waste or borrow areas, stage construction plans, permanent striping and signing plans, road approaches, material source locations and other work.

Many approaches are built using road approach plans adopted by each division. Their location is shown on the Plan and Profile Sheets with a symbol and letter designation. Road approaches are roads that intersect the project on grade without excessive cuts or fills and without restrictive sight distances.

Some road approaches require Special Drawings to show how they fit into the project. These detail the alignment, profile, right-of-way and/or construction easements, typical section and drainage for the road approach.

9.6.1.3.10 Environmental Mitigation

Commitments for environmental mitigation features that are contained in the environmental documentation should be detailed as necessary and included in the project plans as Special Details and/or shown at the appropriate location in the plans.

1. **Erosion Control Plan.** The plan sheets for the erosion control plan are Special Drawings and/or Standard Detail Drawings that detail the measures required to protect resources and to comply with permit stipulations. The plan sheet details should reflect Best Management Practices (BMP); comply with Erosion and Sediment Control on Highway Construction Projects, FHWA, [23 CFR Part 650, Subpart B](#); and be in agreement with the stipulations in the National Pollutant Discharge Elimination System (NPDES) permit.
2. **Wetlands.** Plan sheets for wetland replacement or mitigation are Special Drawings that detail all work required to ensure successful mitigation. These may range from simple sketches to elaborate contour grading and planting plans to conform to the commitments in the environmental document. Pay items may be tabulated on these sheets or on separate sheets.

3. **Other Plans.** Additional plan sheets may be required to address issues (e.g., material source rehabilitation, disposal or borrow area restoration, special landscaping plantings, other enhancing features). These plan sheets could be appropriately placed under this subject area.

9.6.1.3.11 Cross Sections

When Cross Sections are included in the contract plan assembly, show sufficient information on each of the sections to accurately determine the extent of the proposed work. Use a scale that is appropriate for the work.

9.6.1.3.12 Contiguous Projects

A general plan or layout of contiguous construction projects may be beneficial to potential bidders in determining the cost of work on FLH projects. This is particularly true where another agency is constructing a project that will affect FLH contractors. It is essential that the relationship between the projects be well detailed on the plans.

There are instances where as-built plans should be included in the contract plan package. If a bridge or other structure is scheduled for salvage, a set of the as-built plans will greatly assist a contractor in determining the most effective method to disassemble the structure.

On occasion, right-of-way plans or utility plans may be too complicated to incorporate on the Plan and Profile Sheets. They could be inserted into the plans under this subject area.

9.6.2 Specifications

The designer is responsible for the initial preparation of all Special Contract Requirements relating to an individual project. The Special Contract Requirements must conform to the format set forth in [Section 9.4.11](#).

9.6.3 Estimate

The designer prepares the engineer's estimate for each project. The procedures and instructions outlined in [Section 9.4.10](#) discuss the preparation of the estimate.

In addition to the estimated unit costs and total cost for construction, the estimate shows, as separate line items, the estimated costs for construction engineering, utility relocation and other anticipated contingencies.

9.6.4 PS&E Package

The following items represent the minimum requirements necessary to complete a basic PS&E assembly.

- contract drawings,
- Special Contract Requirements,
- engineer's estimate,
- contract time, and
- physical data available to the bidders (e.g., CADD output reports, hydraulic analysis, geotechnical data, cross sections).

9.7 DIVISION PROCEDURES

Reserved for Federal Lands Highway Division office use in supplementing the policy and guidelines set forth in this chapter with appropriate Division procedures and direction.